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PATENT

HM-376

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Hans Streubel et al.
Serial No:	09/715,933
Filed:	November 17, 2000
For:	METHOD FOR CONTINUOUS CASTING OF SLAB, IN PARTICULAR, THIN SLAB AND A DEVICE FOR PERFORMING THE METHOD
Examiner:	Kuang Y. Lin
Art Unit:	1722

Mail Stop Appeal Brief
Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

SUBMISSION OF BRIEF ON APPEAL

SIR:

Submitted herewith is a Brief On Appeal in triplicate in support of the appeal filed August 18, 2003.

A check in the amount of $ 330.00 to cover the fee pursuant to 37 CFR §1.17 (f) is enclosed.

Any additional fees or charges required at this time in connection with the application may be charged to Patent and Trademark Office Deposit Account No. 11-1835.

Respectfully submitted,

FRIEDRICH KUEFFNER

By [signature]

Friedrich Kueffner
(Reg. No. 29,482)
317 Madison Avenue, Suite 910
New York, New York 10017
(212) 986-3114

Dated: October 17, 2003

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, PO Box 1450 Alexandria, VA 22313-1450, on October 17, 2003.

By: [signature]
Friedrich Kueffner

Date: October 17, 2003

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BRIEF ON APPEAL

S I R:

This Appeal Brief is being filed in support of the Notice of Appeal filed August 18, 2003, which appeal was taken from the Final Action dated April 15, 2003.

1. Real Party In Interest

The real party in interest in the above-referenced application is:

SMS Demag AG
Eduard-Schloemann-Strasse 4
40237 Düsseldorf, Germany

2. Related Appeals And Interferences

There are no related appeals or interferences of which Applicant is aware regarding the above-referenced application.

3. Status Of Claims

Claims 1-9 are canceled. Claim 10 stands rejected by the Examiner and is presented to the Board in this Appeal for reconsideration.

4. Status Of Amendments After Final Rejection

No amendments after final rejection have been filed.

5. Summary Of The Invention

The claimed invention is directed to a method for continuous casting of bars, billets, slabs, in particular, thin slabs, which are suitable to measure local temperatures and/or heat flux densities along the height of the casting mold walls and at several locations of its width extension and, based on this, to calculate the temperature load of the casting mold walls in contact with the melt, preferably in the meniscus area. By means of the measured values the operating parameters such as cooling water amount, casting speed, and casting powder are to be controlled such that at a preferred working temperature of the casting mold walls in the meniscus area an optimal surface formation of the slabs is made possible together with an availability of the casting mold as long as possible. (see page 6, lines 2-16 of the specification).

The local temperatures and heat flux densities are measured in the meniscus area, which is critical for the surface quality of a slab. The working temperatures of the casting mold plates in

the meniscus area are maintained within a predetermined temperature range (ΔT) by adjustment of the operating parameters decisive therefor, such as the amount or throughput speed of the cooling water through the casting mold, casting speed, and casting powder to be used. (see page 6, line 17- page 7, line 3 of the specification).

Accordingly, the temperature course along the height of the casting mold plates is determined and, based on this course, the maximum temperatures and thus the location of the meniscus area of the melt in the casting mold are determined. When the optimal heat flux density is known, it is possible to improve the surface quality of the products produced in the continuous casting process, especially for thin slabs. (see page 7, lines 4-11 of the specification).

The casting mold plates are measured by thermoelements arranged at a defined spacing and within a height level (Yi i = 1 to n) above and below the bath level (M), respectively. The thermoelements are arranged at different depths (X_1, X_2) of the wall of the casting mold and, based on the temperature difference of at least two thermoelements positioned approximately at the same height area (Yi, e.g., y_1, y_2), the corresponding local heat flux density is calculated. (see page 7, line 12- page 8, line 1

of the specification).

By determining the temperature course or heat flux course along the height of a wall of the casting mold, the maximum temperature course of the wall surface in contact with the melt is determined by means of approximation functions. When detecting a heat flux density change at the height (y) of the casting mold as a result of two-dimensional heat distribution in the bath level area (M), the position of the bath level (M) is determined based on an assumed heat flux density course at one surface of the casting mold and the known heat flux density in the depth (x) of a casting mold wall. (see page 8, lines 6-18 of the specification).

The best suited casting mold thermal load for an optimal slab surface formation is controlled by adjusting the cooling water quantity and/or the casting speed and/or the casting powder, when the optimal heat flux density or the maximum surface temperature of the casting mold is known. (see page 8, line 19-page 9, line 3 of the specification).

The foregoing is brought out in independent claim 10.

6. Issues

The issues to be resolved are:

1. Whether claim 10 is indefinite under 35 U.S.C. 112, second paragraph.
2. Whether claim 10 is unpatentable under 35 U.S.C. 103(a) over either JP 6-320,245 or JP 6-304,727.

7. Grouping Of Claims

There is only one claim on appeal.

8. Argument

i. Arguments Pertaining To The Rejection Under 35 U.S.C. 112

It is submitted that the claim as written are definite and readily understandable by those skilled in the art. Furthermore, the claim language that the Examiner finds to be indefinite in claim 10 was present in the claims originally filed with the application, namely original claims 7 and 8. Therefore it seems inaccurate for the Examiner to reject original claims 7 and 8 over prior art but never raise the formal rejections that are only now presented in the final rejection. Thus, it is

respectfully submitted that the Examiner understood the claims as originally filed, as would one skilled in the art, and therefore the same claim language now found in claim 10 is definite and understandable by those skilled in the art. If the claim is truly indefinite then this rejection should have been raised years ago before rejections based upon prior art, or at least at the same time as the first rejection based upon prior art. If the Examiner is only now not clear about the meaning of the claims then maybe his prior art rejection is based on an incorrect understanding of the invention. If that is the case it would seem appropriate to remand the case back to the Examiner to resolve the section 112 problems so that a more accurate prior art examination can be undertaken.

It is therefore requested that the rejection of claim 10 under 35 U.S.C. 112, second paragraph is incorrect and should be overturned.

ii. Arguments Pertaining to The Rejection Under 35 U.S.C. 103

In his rejection the Examiner stated:"... each of the prior art references substantially show the invention as claimed except that the strand dimension is not disclosed. However, it would have been obvious that the inventive concept of the prior art process can be adapted for casting any shape or configuration of the strand to obtain the optimal product quality."

JP 6-304727 discloses heat flux being monitored by heat flux sensors and casting velocity being detected by casting velocity detecting means. JP 6-320245 discloses heat flux meters for measuring heat extraction in the mold as well as casting speed detection means. Neither of the cited prior art references shows that for measuring temperature differences first and second thermoelements are arranged in first and second parallel rows at uniform vertical spacing to one another, wherein based on the measured temperature differences the local heat flux density is calculated and, based on the determination of the course of the local temperatures or the heat flux along the height of the casting mold wall, the maximum temperature course of the wall surface in contact with the melt and thus the temperature range ΔT are determined.

The present invention defines a method according to which the best suited casting mold load for an optimal slab surface formation is controlled, when knowing the optimal heat flux density or the maximum surface temperature, by adjusting at least one of the operating parameters selected from the group consisting of cooling water quantity and casting speed and casting powder. Accordingly, based on the optimal heat flux density or the maximum surface temperature, the operating parameters, i.e., cooling water quantity, casting speed, and/or casting powder, are adjusted in order to thereby provide the best casting mold load for optimal surface formation.

The prior art JP 6-304727 discloses heat flux being monitored by heat flux sensors and casting velocity being detected by casting velocity detecting means. The data obtained in this way are processed in order to determine whether the heat flux is within a proper range or within a range where surface flaws could develop. If the critical range is reached, the casting velocity is changed to thereby prevent surface flaws.

Accordingly, both prior art methods only disclose triggering of corrective measures in response to detecting that the heat flux is within the critical range. This has nothing to do with the concept of the present invention according to which, based on

the known optimal heat flux density or the known maximum surface temperature, the operating parameters, i.e., cooling water quantity, casting speed, and/or casting powder, are adjusted in order to thereby control the best casting mold load for optimal slab surface formation.

It is respectfully submitted that it is only the combination of features found in the improvement portion of claim 10 which makes it possible to meet the object of the present invention which is to control by means of the measured values the operating parameters, such as cooling water amount, casting speed and casting powder, in such a way that, at a preferred working temperature of the casting mold walls in the meniscus area, an optimum surface formation of the cast products is made possible together with an availability of the casting mold which is as long as possible.

In conclusion it is respectfully submitted that the rejection of claim 10 under 35 U.S.C. 103(a) is in error and should be overturned.

A check in the amount of $330.00 for the Appeal Brief fee required by 37 C.F.R. 1.17(c) is also enclosed. This Appeal Brief is also being filed in triplicate.

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By: [signature]
Friedrich Kueffner

Date: October 17, 2003

9. Appendix

10. In a method for continuous casting bars, billet, and slabs from a melt in dimensional ranges of approximately 20 to 150 mm thickness and approximately 600 to 3500 mm width by means of an oscillating, water-cooled casting mold in cooperation with a submerged-entry nozzle, employing casting powder for formation of casting slag, the method including the steps of:

measuring local temperatures and local heat flux densities of a casting mold in a meniscus area of the melt critical for the surface quality of a slab;

maintaining working temperatures of the casting mold plates in the meniscus area within a predetermined temperature range (ΔT) by adjusting operating parameters selected from the group consisting of the quantity of the cooling water, the throughput speed of the cooling water through the casting mold, the casting speed, and the casting powder to be used;

arranging thermoelements in the casting mold plates at a defined spacing from one another and within a height range above and below the bath level, respectively, for determining the working temperatures of the casting mold plates, wherein the thermoelements are arranged at different depths in the casting mold wall and wherein, based on a temperature difference of at least two of the thermoelements positioned substantially at the

same height, the corresponding local heat flux density is calculated;

calculating a maximum temperature course of the wall surface in contact with the melt by means of approximation functions, based on a measurement of the course of the local temperatures or the heat flux along a height of the casting mold wall;

the improvement comprising:

determining when a change of the heat flux density is measured along the height of the casting mold wall as a result of two-dimensional heat transfer in the area of the bath level (M), the position of the bath level (M) based on an assumed heat density course in a casting mold surface and the known heat flux density in the depth (x) of a casting mold wall; and

controlling, when knowing the optimal flux density or the maximum surface temperature, the best suited casting mold load for an optimal slab surface formation by adjusting at least one of the operating parameters selected from the group consisting of cooling water quantity and casting speed and casting powder.

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By determining the temperature course or heat flux course along the height of a wall of the casting mold, the maximum temperature course of the wall surface in contact with the melt is determined by means of approximation functions. When detecting a heat flux density change at the height (y) of the casting mold as a result of two-dimensional heat distribution in the bath level area (M), the position of the bath level (M) is determined based on an assumed heat flux density course at one surface of the casting mold and the known heat flux density in the depth (x) of a casting mold wall. (see page 8, lines 6-18 of the specification).

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Friedrich Kueffner

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measuring local temperatures and local heat flux densities of a casting mold in a meniscus area of the melt critical for the surface quality of a slab;

maintaining working temperatures of the casting mold plates in the meniscus area within a predetermined temperature range (ΔT) by adjusting operating parameters selected from the group consisting of the quantity of the cooling water, the throughput speed of the cooling water through the casting mold, the casting speed, and the casting powder to be used;

arranging thermoelements in the casting mold plates at a defined spacing from one another and within a height range above and below the bath level, respectively, for determining the working temperatures of the casting mold plates, wherein the thermoelements are arranged at different depths in the casting mold wall and wherein, based on a temperature difference of at least two of the thermoelements positioned substantially at the

same height, the corresponding local heat flux density is calculated;

calculating a maximum temperature course of the wall surface in contact with the melt by means of approximation functions, based on a measurement of the course of the local temperatures or the heat flux along a height of the casting mold wall;

the improvement comprising:

determining when a change of the heat flux density is measured along the height of the casting mold wall as a result of two-dimensional heat transfer in the area of the bath level (M), the position of the bath level (M) based on an assumed heat density course in a casting mold surface and the known heat flux density in the depth (x) of a casting mold wall; and

controlling, when knowing the optimal flux density or the maximum surface temperature, the best suited casting mold load for an optimal slab surface formation by adjusting at least one of the operating parameters selected from the group consisting of cooling water quantity and casting speed and casting powder.